



PATENT  
Docket No. 290252016600

Morrison & Foerster LLP  
755 Page Mill Road  
Palo Alto, California 94304-1018

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*Yvonne Staben*  
Yvonne Staben

APPLICATION TRANSMITTAL LETTER  
37 C.F.R. § 1.53(b)(1)

Box PATENT APPLICATION  
Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Transmitted herewith for filing is the patent application under 37 C.F.R. §1.53(b)(1) of Son M. Gia for DETACHABLE MULTIDIAMETER VASOOCCCLUSIVE COIL.

Enclosed are:

- 4 Pages of specification.
- 2 Pages of claims.
- Cover page (1 page).
- 1 Page of abstract.
- 1 Sheet(s) of drawing(s).
- Declaration of the inventor unsigned (2 pages).
- Power of Attorney and Prosecution by Assignee under 37 C.F.R. § 3.71.
- Assignment.
- Assignment Recordation Form.
- Computer program in microfiche.
- Verified statement(s) claiming small entity status.
- Other: Poscard and certificate of Express Mail.

The filing fee has been calculated as follows:

FOR	NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS
TOTAL CLAIMS	5 - 20 =	0	x \$22.00	\$0
INDEPENDENT CLAIMS	2 - 3 =	0	x \$80.00	\$0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	N/A
			BASIC FEE	\$770.00
		TOTAL OF ABOVE CALCULATIONS =		\$770.00
Reduction by 1/2 for filing by small entity (Note 37 C.F.R. §§ 1.9, 1.27, 1.28). If applicable, verified statement must be attached.				N/A
Assignment Recording Fee (if enclosed)				N/A
		TOTAL =		N/A

- A check in the amount of N/A is attached.
- Charge N/A to **Deposit Account No. 03-1952**.
- The Assistant Commissioner is hereby authorized to charge any additional fees under 37 C.F.R. §§ 1.16 or 1.21 that may be required by this transmittal, or to credit any overpayment, to **Deposit Account No. 03-1952**. A duplicate copy of this transmittal is enclosed for that purpose.

Dated: October 25, 1996

Respectfully submitted,

By: \_\_\_\_\_

*Thomas E. Ciotti*

Thomas E. Ciotti  
Registration No. 21,013

Morrison & Foerster LLP  
755 Page Mill Road  
Palo Alto, California 94304-1018  
Telephone: (415) 813-5702  
Facsimile: (415) 494-0792



## DETACHABLE MULTIDIAMETER VASOOCCCLUSIVE COIL

Inventor: Son M. Gia

Prepared by;  
Thomas E. Ciotti  
Morrison & Foerster LLP  
755 Page Mill Road  
Palo Alto, California 94304-1018  
(415) 813-5600  
Attorney Docket No. 290252016600

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### Certificate of Express Mail

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Yvonna Staben  
Yvonna Staben

October 25, 1996

Date



## DETACHABLE MULTIDIAMETER VASOOCCCLUSIVE COIL

### TECHNICAL FIELD

This invention is in the field of vasoocclusion devices. More particularly it  
5 relates to a helical vasoocclusion coil one end of which is adapted to be detachably connected to a wire and in which the helix winding at that end has a smaller diameter than the adjacent windings.

### BACKGROUND

Vasoocclusion devices are surgical instruments that are placed within vessels,  
10 typically via a catheter, to block the vessel or to fill a vascular cavity such as an aneurysm. One type of vasoocclusion device is in the form of a helical wire coil. See U. S. Patent No. 4,994,069. The coil may be placed at the desired site in several ways. One involves loading the coil into the lumen of a catheter whose distal end is located at the site. The coil is then advanced through the catheter lumen using a  
15 pusher and expelled from the distal end of the catheter. Another involves detachably coupling the coil to the distal end of a wire, advancing the assembly to the site using a catheter, and uncoupling the coil from the wire at the site. U. S. Patents Nos. 5,234,437; 5,250,071; 5,261,916; 5,304,195; 5,312,415; and 5,350,397 describe coils that are detachably coupled to a wire.

20 Detachable coils carry a member on their proximal end that detachably engages or interlocks with a member on the distal end of the wire. A problem experienced with such coils is that the member carried on the coil is oriented tangentially to the helical diameter of the coil. As such, when the coil is decoupled, the member extends tangentially outwardly from the helix diameter and may engage

the vessel wall. (See Figure 1 of the drawings) Such engagement may injure or even perforate the vessel wall.

A principal object of this invention is to provide a detachable helical vasoocclusive coil in which the member that attaches to the wire is not oriented tangentially to the diameter of the coil. Accordingly, the coils of this invention are less likely to injure the vessel wall.

#### DISCLOSURE OF THE INVENTION

One aspect of the invention is a helical vasoocclusion coil for use with a wire having a distal end, said coil having: (a) a proximal end adapted to detachably couple to the distal end of the wire; (b) a distal end; (c) a first diameter intermediate (a) and (b); and (d) a second diameter smaller than said first diameter at said proximal end whereby said proximal end is positioned radially inwardly of said first diameter.

Another object of the invention is an assembly for use in occluding a vessel or a cavity within a vessel comprising: a wire having a distal end that carries a first coupling member; and a helical vasoocclusion coil having: (i) a proximal end that carries a second coupling member that is detachably coupled to the first coupling member; (ii) a distal end; (iii) a first diameter intermediate (i) and (ii); and (iv) a second diameter smaller than said first diameter at said proximal end whereby the first coupling member is positioned radially inwardly of said first diameter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which are not to scale:

Figure 1 is an elevational view of a prior art coil.

Figure 2 is an elevational end view of one embodiment of the invention.

Figure 3 is an elevational partial side view of the coil of Figure 2.

### MODES FOR CARRYING OUT THE INVENTION

Figures 2 and 3 depict an embodiment, generally designated 10, of the invention coil. Embodiment 10 is shown in its relaxed, helical configuration. As described in the art discussed in the Background section above, helical vasoocclusive coils are typically made of materials that have shape memories and can be deformed into an expanded, essentially linear shape for loading and advancement through a catheter to the site to be occluded. Once they are deployed from the catheter they assume a relaxed helical configuration, such as shown in Figure 3.

Coil 10 is composed of a multiplicity of windings 11 and has a distal end 12 and a proximal end 13. The windings of coil 10 will typically be made of a metal such as platinum, gold, rhodium, rhenium, palladium, tungsten and the like or alloys of such metals. These metals have significant radiopacity and their alloys may be tailored to provide desired degrees of stiffness and flexibility. The windings may be made of other suitable biocompatible materials such as polymers or composites of metals and polymers.

While the cross-section of the windings of the coil 10 is circular, windings having other cross-sectional shapes, e.g. elliptical, trapezoidal, rhombic, rectangular, and square, may be used. Circular cross-sectional windings will typically have a diameter of about 0.01 to about 0.50 mm. Correspondingly, the diameter of the helix, D (Figure 3), formed by the windings will normally be in the range of about 0.2 mm to about 30 mm. For neurovascular use the diameter of the helix will typically be in the range of 2.0 to 20 mm. The pitch of the windings may be uniform, as shown in Figure 3, or may vary over a portion or the entire length of the coil. The axial length of the coil will usually be in the range of 0.5 to 100 cm, more usually 2 to 40 cm. The coil will usually have 10 to 75 windings per cm, more usually 10 to 40 windings per cm. It will be appreciated that the above-described dimensions are not critical

and that dimensions that are suitable for occluding vascular sites within the human body are intended.

As shown in Figure 3, the windings of the main body 14 of the coil form a helix of diameter D, whereas the proximal-most and distal-most windings have a diameter d that is smaller than D. As a result, the proximal and distal ends 12, 13, respectively, of the coil are located radially inwardly of the helix of main body 14 (Figure 2) rather than being located tangentially to that helix (Figure 1). Such positioning of the ends make the ends less likely to injure the vessel wall. As seen in Figures 2 and 3, the proximal end 13 of the coil has a slotted member 15 that is adapted to detachably couple to a mating member on the distal end of an elongated wire (not shown). Alternative mechanical coupling members are shown in U. S. Patents Nos. 5,234,437; 5,250,071; 5,261,916; 5,304,195; 5,312,415 and 5,350,397, the disclosures of which with respect thereto are incorporated herein by reference.

While not shown in the drawings, the coil may have fibers attached to it to facilitate embolization. See U. S. Patents Nos. 5,304,194; 5,476,472 and 5,382,259, the relevant disclosures of which are incorporated herein by reference. Other modifications of the above described modes for carrying out the invention that are considered obvious or equivalent by those of skill in the medical device art and related arts are intended to be within the scope of the following claims.

20

CLAIMS

1. A helical vasoocclusion coil for use with a wire having a distal end, said coil having:

(a) a proximal end adapted to detachably couple to the distal end  
5 of the wire;

(b) a distal end;

(c) a first diameter intermediate (a) and (b); and

(d) 10 a second diameter smaller than said first diameter at said proximal end whereby said proximal end is positioned radially inwardly of said first diameter.

2. The coil of claim 1 wherein the second diameter is also at the distal end of the coil whereby the distal end of the coil is also positioned radially inwardly of said first diameter.

3. 15 The coil of claim 1 wherein said proximal end has a coupling member that detachably interlocks with the distal end of the wire.

4. An assembly for use in occluding a vessel or a cavity within a vessel comprising:

(a) an elongated wire having a distal end that carries a first coupling member; and

20 (b) a helical vasoocclusion coil having:

(i) a proximal end that carries a second coupling member that is detachably coupled to the first coupling member;

(ii) a distal end;

(iii) a first diameter intermediate (i) and (ii); and

(iv) a second diameter smaller than said first diameter at said proximal end whereby the first coupling member is positioned radially inwardly of said first diameter.

5        The assembly of claim 4 wherein the second diameter is also at the  
distal end of the coil whereby the distal end of the coil is also positioned radially  
inwardly of said first diameter.

ABSTRACT OF THE DISCLOSURE

A vasoocclusive helical coil having a proximal end that carries a coupling member for attaching the coil to the distal end of a wire and a proximal winding that has a smaller diameter than adjacent windings whereby the proximal end of the coil is  
5 positioned radially inwardly of the main body of the coil.

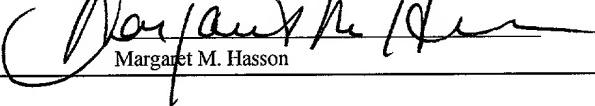
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PATENT  
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CERTIFICATE OF MAILING BY "FIRST CLASS MAIL"

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Assistant Commissioner for Patents, Washington, D.C. 20231, on January 14, 1997.

  
Margaret M. Hasson

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Son M. Gia

Serial No.: 08/736,896

Filing Date: October 25, 1996

For: DETACHABLE MULTIDIAMETER  
VASOOCCLUSIVE COIL

Examiner: Not Yet Assigned

Group Art Unit: 3309

**CONSENT OF ASSIGNEE TO CORRECT INVENTORSHIP**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Target Therapeutics, the assignee of the subject application, hereby consents to the correction of the inventorship in the subject application

from: Son M Gia, as sole inventor

to: Christopher G. M. Ken and Abhijit Acharya, as joint inventors.

TARGET THERAPEUTICS

By: 

Title: Sr. Vice President

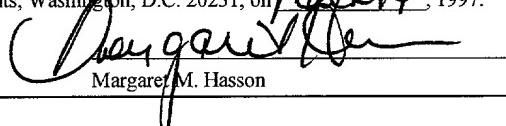
Date: 1/28/97



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For: DETACHABLE MULTIDIAMETER  
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Examiner: Not Yet Assigned

Group Art Unit: 3309

PROSECUTION BY ASSIGNEE UNDER 37 C.F.R. § 3.71

Box Missing Parts  
Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Target Therapeutics, Inc., the assignee of the entire right, title and interest in this patent application, under 37 C.F.R. § 3.71 hereby appoints:

Thomas E. Ciotti (Reg No. 21,013)  
Gladys H. Monroy (Reg No. 32,430)  
Paul Schenck (Reg No. 27,253)  
Freddie K. Park (Reg No. 35,636)  
Patricia M. Drost (Reg No. 29,790)  
Tyler Dylan (Reg No. 37,612)  
Gary A. Green (Reg No. 38,474)  
Harry J. Macey (Reg No. 32,818)

Kate H. Murashige (Reg No. 29,959)  
Debra Shetka (Reg No. 33,309)  
E. Thomas Wheelock (Reg No. 28,825)  
Susan K. Lehnhardt (Reg No. 33,943)  
Shmuel Livnat (Reg No. 33,949)  
Reid G. Adler (Reg No. 30,988)  
Antoinette F. Konski (Reg No. 34,202)  
Stuart P. Kaler (Reg No. 35,913)

David L. Bradfute (Reg No. 39,117)  
Laurie A. Axford (Reg No. 35,053)  
Catherine M. Polizzi (Reg No. 40,130)  
James C. Peacock III (Reg No. 40,124)  
Robert A. Millman (Reg No. 36,217)  
Ronald D. Devore (Reg No. 39,958)

Robert Saltzberg (Reg No. 36,910)  
Mani Adeli (Reg No. 39,585)  
Sean Brennan (Reg No. 39,917)  
J. Michael Schiff (Reg No. 40,253)  
Robert K. Cerpa (Reg No. 39,933)  
Lee K. Tan (Reg No. 39,447)

all of Morrison & Foerster LLP, 755 Page Mill Road, Palo Alto, California 94304-1018, telephone (415) 813-5600, to prosecute this application and transact all matters in the United States Patent and Trademark Office connected therewith, said appointment to be to the exclusion of the inventors and their attorneys in accordance with the provisions of 37 C.F.R. § 3.71.

Please direct all written communications relative to this application to:

Thomas E. Ciotti  
Morrison & Foerster LLP  
755 Page Mill Road  
Palo Alto, California 94304-1018

Please direct all telephone communications to Thomas E. Ciotti at (415) 813-5702.

Dated: 1/28, 1997

Respectfully submitted,  
Target Therapeutics, Inc.

By: Name: Erik T. Engelson  
Title: Sr. Vice President  
Address 47201 Lakeview Boulevard  
Fremont, California 94537



PATENT  
Docket No. 290252016600

*H* *B*

## DECLARATION FOR UTILITY PATENT APPLICATION

AS A BELOW-NAMED INVENTOR, I HEREBY DECLARE THAT:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled: DETACHABLE MULTIDIAMETER VASOCOCLUSIVE COIL, the specification of which is attached hereto unless the following box is checked:

was filed on October 25, 1996 as United States Application Serial No. 08/736,896 and was amended on \_\_\_\_\_ (if applicable).

I HEREBY STATE THAT I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE.

I acknowledge the duty to disclose information which is material to the patentability as defined in 37 C.F.R. § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Application No.	Country	Date of Filing (day/month/year)	Priority Claimed?
			<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

Application Serial No.	Filing Date

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to

PATENT  
Docket No. 290252016600

patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application Serial No.	Filing Date	Status
		<input type="checkbox"/> Patented <input type="checkbox"/> Pending <input type="checkbox"/> Abandoned

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Jan 28, 1997

Date

Name: Christopher G. M. Ken  
Residence: San Mateo, California CA  
Citizenship: USA  
Post Office Address: 652 West Hillsdale Boulevard  
San Mateo, California 94403

1/28/97

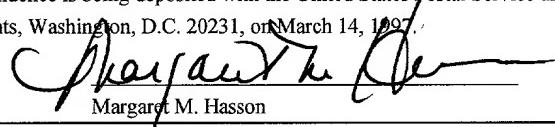
Name: Abhijit Acharya  
Residence: Saratoga, California CA  
Citizenship: USA  
Post Office Address: 13773 Lexington Court  
Saratoga, California 95070



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Serial No.: 08/736,896

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VASOOCCLUSIVE COIL

Examiner: Not Yet Assigned

Group Art Unit: 3309

DECLARATION OF THOMAS E. CIOTTI

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

I, Thomas E. Ciotti, declare as follows:

1. I represent Target Therapeutics, the assignee of this application, and am the attorney responsible for preparing and filing this application.
2. The filing papers in this application erroneously named Son M. Gia as the sole inventor in this application. This error occurred when my secretary confused this application with an earlier filed application which properly named Son M. Gia as the sole inventor and filled out the application papers incorrectly. I did not notice this error in reviewing the filing papers before they were mailed to the United States Patent and Trademark Office. The error was discovered on

or about 15 January 1997 in connection with responding to the Notice to File Missing Parts of Application for this application.

3. Neither the erroneous originally named inventor nor the actual inventors had any role in making this error or any knowledge that the error had been made. Accordingly, I believe it was not possible for any of them to have had any deceptive intent with respect to the incorrect naming of Son M. Gia as an inventor.

4. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Dated: March 14, 1997

Respectfully submitted,

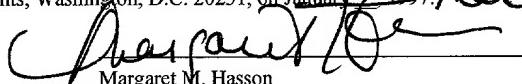
By: Thomas E. Ciotti  
Thomas E. Ciotti  
Registration No. 21,013

Morrison & Foerster LLP  
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Palo Alto, California 94304-1018  
Telephone: (415) 813-5702  
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Examiner: Not Yet Assigned

Group Art Unit: 3309

**STATEMENT BY ORIGINALLY NAMED INVENTOR IN SUPPORT OF PETITION  
TO CORRECT INVENTORSHIP**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

I, Son M. Gia, declare as follows:

1. I was an employee of Target Therapeutics (Target), the assignee of the subject application.
2. I have reviewed a copy of the subject application and believe I am not an inventor thereof.
3. I was advised on January 16, 1997 by Target's patent attorney, Thomas E. Ciotti, that I was named as the sole inventor in the filing papers of the subject application. That is clearly an error. Mr. Ciotti further advised that this error occurred as a result of a clerical error in

his office and that he discovered the error on January 15, 1997. Prior to January 16, 1997 I had no knowledge that I had been erroneously named as the sole inventor of the subject application.

4. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Dated: 3/31/97

By:   
Son M. Gia

1/1

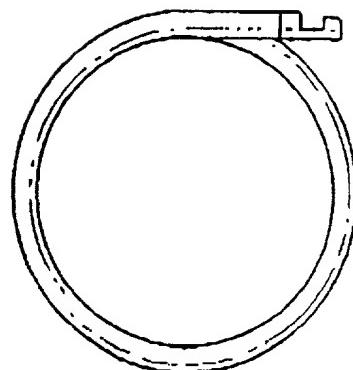


Fig. 1  
(PRIOR ART)

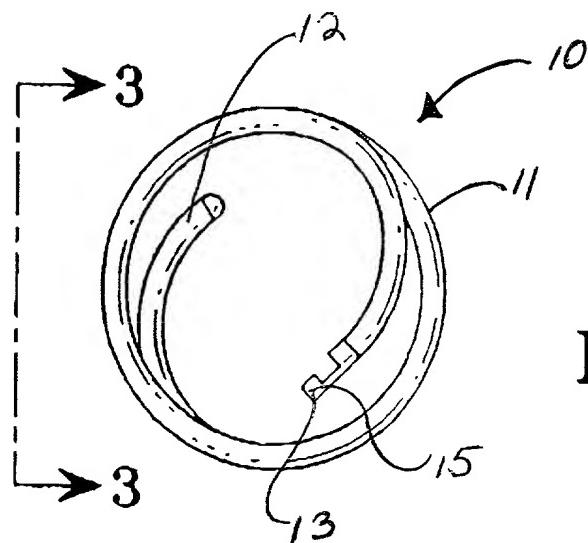


Fig. 2

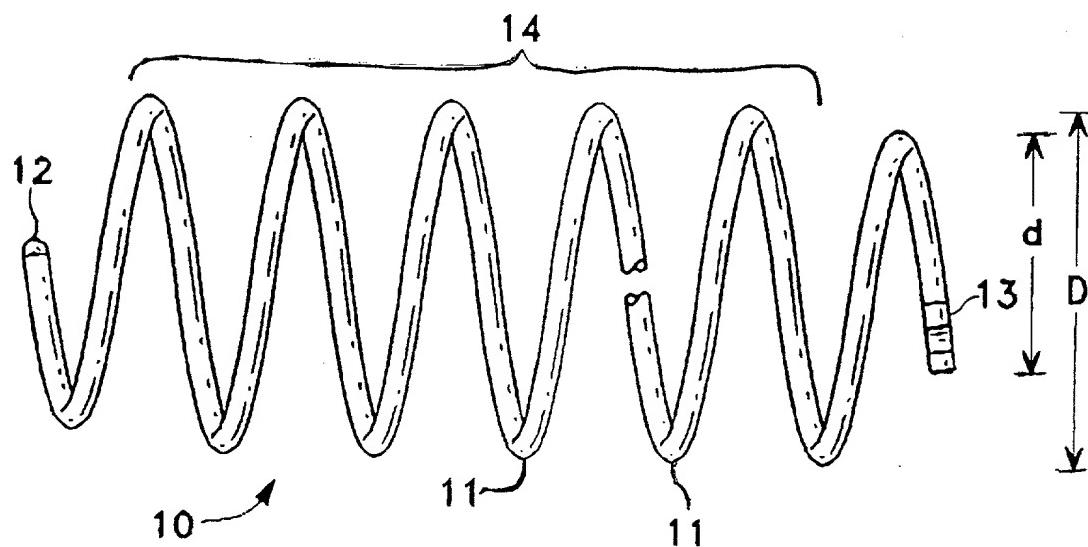


Fig. 3